Problem 1 : Let \( n \) be a positive integer. Find a formula for \( I(n) \), where
\[
I(n) = \frac{1}{\pi} \int_{-\pi}^{\pi} x^2 \cos(nx) \, dx.
\]

Problem 2 : Let \( F(a) \) be the area under the graph of \( f(x) = x^5e^{-x^3} \) for \( 0 \leq x \leq a \).

1. Find a formula for \( F(a) \). Your formula should not include any integrals.
2. Use your calculator to plot \( F(a) \). What happens to the value of \( F(a) \) for large values of \( a \)?
3. Explain the behavior of \( F(a) \) for large values of \( a \) in terms of the graph of \( f(x) \).

Problem 3 : The values of \( f(x) \) and \( g(x) \) are in the table.

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>-1</td>
<td>.4</td>
<td>1</td>
<td>1.4</td>
<td>1.7</td>
</tr>
<tr>
<td>( g(x) )</td>
<td>0</td>
<td>.5</td>
<td>.8</td>
<td>.3</td>
<td>.1</td>
</tr>
</tbody>
</table>

1. Estimate the value of \( \int_{0}^{8} f(t) \, dt \) and \( \int_{0}^{8} f(t)g(t) \, dt \) using the midpoint and the trapezoid rule. Use the largest amount of subdivisions possible in each approximation.
2. Assume \( f(x) \) is continuous with no critical points or points of inflections on \( 0 \leq x \leq 8 \). Which approximation (left, right, trapezoid, or midpoint) is guaranteed to give an underestimate of \( \int_{0}^{8} f(t) \, dt \) ? There may be more than one.

Problem 4 : Section 8.1 #26.